Work Completed

This week we received the full order from Midwest Motion Control. The motor we ordered is below in Figure 1. The output parameters for the gearmotor are 72 in-lbs continuous torque, 285 RPM output speed, 48 VDC, and 8.1 A continuous current. This motor is a huge improvement on our original findings because the speed is nearly 6 times faster.

![Figure 1: MMP S28-150E-48V GP81-014 DC Gearmotor](image)

In order to control this motor at variable speeds a specific motor control is needed. Randy from Midwest Motion Products was also able to recommend a compatible PWM speed control that operates a motor up to 48 VDC and 25A. The input voltage range is a 36-60 VDC through a battery or a DC Power Supply. The motor control is not set up for reversible operation; so that needs to be modified as outlined in Figure 2, next page, by reversing the positive and negative voltage input to the motor. The advantage to this motor control over the proposed circuit design is its compact size (4.5” x 2” x 1.5”) and reliability of the circuitry. Current is also no longer an issue because this motor control unit can safely handle up to 25 A. This allows us to focus on attaching the handle to the
control box instead of worrying about the suitability of the motor with the control. Of course we are still going to pursue the circuit design with a microcontroller chip as an alternative design.

Lastly, an AC to DC Power Supply converter was also purchased through Midwest Motion Products. This power supply offers a compact size (11.5cm x 21.5 cm x 5cm), lightweight and high reliability design. This will easily fit below the frame of the bed and it comes complete with a cooling fan system to prevent any overheating. An AC line cord was also purchased to plug the power supply into a universal outlet on the wall. Figure 2, next page, has the interconnection of the motor speed control unit.

![Figure 2. Interconnection of the Motor Speed Control Unit](image)

I started to brainstorm some new ideas of attaching the scissor jack. It seems as though the turnbuckle idea for allowing rotation of the jack as the bed angle changed may cause some issues with load bearing on the joints and possibly even binding up in operation. To eliminate these issues, I suggested a solid joint at the base of the jack instead of a pivot and some kind of wheel-in-track system to attach to the back of the bed. This way the jack will lift the load vertically, eliminating all angle changes. Since the jack would no longer tilt with
the back of the bed, a wheel will be attached to the top of the jack and ride in the track placed on the back of the bed. As the jack rises, the bed back will rise smoothly along the wheel-in-track system. A simple polyurethane fixed castor wheel shown in Figure 3 below would be sufficient. Some kind of parallel metal bars can be built around it on the back of the bed to roll straight on track.

![Figure 3. FIXED PLATE FIXING POLYURETHANE WHEEL](abbeypowertools.co.uk)

**Future Work**

In the coming week we will continue to characterize our parts that came in by loading the motor to measure the current-load characteristics. We can begin to connect the DC gearmotor, motor speed control, AC to DC power supply, and AC line cord for the power supply to understand the full operation of the motor. We will also be able to finalize the dimensions of the steel cage design that encloses the motor and attaches it to the scissor jack. Future expenses include labor and cost of welding (~$80), a castor wheel for the track (~$25), and plywood to finish framing the bed (~$25).

**Project Review**

At this point the bed frame has been ordered and will hopefully be in by Friday to start connecting our device together. The DC gearmotor, AC to DC power supply, motor speed control, and AC line cord for the power supply have arrived and we started to hook them up in circuit. These were our last major purchases for awhile and we are still within budget with $685 remaining. We have currently spent about $1315 of our $2,000 budget.

**Hours Worked**

12 hours